

REMARKS

Applicant respectfully requests reconsideration. Independent claim 32 has been amended to include the recitation of claim 35. Claims 34 and 35 have been cancelled. No new matter has been added. Claims 11, 13, 15, 20-24, 26-32, 36-37, 39-41 and 45-52 are now pending in this application, with claims 11 and 32 being independent claims.

Rejection of Claims 11, 13-15, 21-24, 26-30, 32-37, 39-41 and 45-52

Claims 11, 13-15, 21-24, 26-30, 32-37, 39-41 and 45-52 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,734,195 (Takizawa) in view of U.S. Patent No. 5,298,452 (Meyerson) or U.S. Patent No. 5,221,412 (Kagata), and further in view of U.S. Patent No. 3,897,625 (Tihanyi), or the English Abstract of Japanese Patent No. 8-8262 (Takiyama). Applicant respectfully traverses this rejection.

Takizawa discloses a process in which a second element present in a semiconductor substrate accelerates oxygen precipitation to form crystal defects in the substrate which serve as gettering sites (e.g., See 1st Paragraph, Summary of Invention). An epitaxial layer is subsequently grown (e.g., after an annealing step) on the gettering site region at a temperature of about 1,150 °C (e.g., See Column 4, lines 47-51). In the embodiment relied on in the Office Action, the second element (e.g., carbon) is implanted and the crystal defects are formed in the epitaxial growth step (e.g., See 1st Paragraph, Summary of Invention). Takizawa notes the importance of temperature in the epitaxial growth step in generating the crystal defects and, thus, improving the gettering capability (e.g., See Column 6, lines 1-12).

One of ordinary skill in the art would not have been motivated to modify the Takizawa process to include the step of depositing a silicon layer at a temperature of less than 750 °C, as taught by Meyerson or Kagata, and recited in independent claims 11 and 32 (as amended). As noted above, Takizawa's epitaxial growth step is conducted at far higher temperatures of about 1,150 °C. Moreover, the Takizawa process relies on the precipitation of oxygen to form crystal defects that serve gettering sites which depends on the temperature (and time) of the epitaxial growth step. At significantly lower epitaxial growth temperatures, less oxygen precipitation and crystal defect generation would be expected which would reduce gettering capability. One of ordinary skill, therefore, would not have been motivated to use the significantly lower deposition

temperatures taught by Meyerson or Kagata (and claimed) because of the expected sacrifice in the gettering capability of the resulting wafer which is a key function of Takizawa's process.

Because one of ordinary skill in the art would not have been motivated to combine Takizawa in view of either Meyerson or Kagata, a *prima facie* case of obvious has not been met for independent claims 11 and 32. Accordingly, claims 11 and 32 are patentable over the asserted combination(s) of Takizawa in view of Meyerson or Kagata, and further in view of Tihanyi or Takiyama. The dependent claims that stand rejected on this ground are, therefore, also patentable over these combinations.

Furthermore, even if one combined the teachings of Takizawa in view of Meyerson or Kagata, and further in view of Tihanyi or Takiyama in the manner stated in the Office Action, all of the recited steps of independent claims 11 and 32 would not be taught or suggested. Both Tihanyi and Takiyama fail to teach or suggest the claimed step of forming a window in a layer on a substrate.

Tihanyi teaches steps in which layers (e.g., layer 3 and layer 4) are formed and patterned on a layer 2 (e.g., silicon) which is formed on a substrate. However, Tihanyi never forms a window on the substrate as claimed, much less a window that exposes a region of the substrate to a subsequent implant step as in the claimed process.

Takiyama discloses formation of a silicon nitride film 3 including a silicon oxide film 5 formed on its sidewalls which functions as a mask. However, Takiyama never forms a window on a substrate to expose a region of the substrate as claimed.

Because even if one combined the teachings of the references in the manner stated in the Office Action, all of the recited steps of independent claims 11 and 32 would not be taught or suggested, a *prima facie* case of obvious has not been met for independent claims 11 and 32 for at least this reason. Accordingly, claims 11 and 32 are patentable over the asserted combination(s) of Takizawa in view of Meyerson or Kagata, and further in view of Tihanyi or Takiyama. The dependent claims that stand rejected on this ground are, therefore, also patentable over these combinations.

Also, even if one combined the teachings of Takizawa in view of Kagata, and further in view of Tihanyi or Takiyama in the manner stated in the Office Action, all of the recited steps of independent claims 11 and 32 would not be taught or suggested. In particular, these

combinations would fail to teach the step of claims 11 and 32 that recites depositing a silicon layer at a temperature of less than 750 °C prior to annealing the substrate. The Kagata process includes a pre-treatment step in which the substrate is heated preferably to a temperature of about 1,000 °C or higher, for a period of 30 minutes or longer (e.g., See Column 2, lines 48-52). This pre-treatment step is required to achieve the claimed deposition temperatures of less than 750 °C. (e.g., See Column 3, lines 42-56). This pre-treatment step is at conditions similar to those in typical conventional annealing steps. Thus, it would be expected that the pre-treatment step would function as an annealing step if performed after an implantation step, as suggested in the proposed combination in the Office Action. Because the claims preclude an annealing step prior to depositing the silicon layer, the combinations of Takizawa in view of Kagata, and further in view of Tihanyi or Takiyama fail to teach or suggest each claim limitation and, in fact, teaches away from the claimed method.

Thus, independent claims 11 and 32 (as well as their dependent claims) are patentable over the combinations of Takizawa in view of Kagata, and further in view of Tihanyi or Takiyama for at least this reason.

Furthermore, Applicant respectfully disagrees that the recitation in independent claim 32 (and dependent claim 27) that the silicon layer has a different crystalline orientation than the substrate would have been inherent in the combinations of Takizawa in view of Meyerson or Kagata, and further in view of Tihanyi or Takiyama. Though, it is recognized in the Office Action that these combinations fail to teach this feature, it is asserted that this feature would have been inherent in the combined processes because the combinations teach a similar method as claimed.

As noted in previous responses, to begin with, the Applicant points out that the burden is on the Patent Office to establish the inherency in the prior art of each and every claim limitation.¹ The Office Action appears to rely on the assertion that the combination teaches certain steps (e.g., implant and layer deposition steps) that are also part of the claimed method. However, the

¹ To meet this burden, "the Examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art" (MPEP §2112 quoting Ex parte Levy, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Int. 1990)(emphasis in original quotation)). The fact that a certain characteristic may be present in the prior art is not sufficient to establish the inherency of that result or characteristic (see MPEP §2112). The limitation must necessarily be present in the

cited references describe significantly different conditions in connection with these steps than the conditions described in the present application.

For example, Takizawa's implant step is at much higher energies (e.g., 200 keV, 400 keV, 800 keV – See Column 5, lines 43-51) as compared to the implant energies disclosed in the present application (e.g., 10 keV – See Page 5, lines 9-11). As described in the present application, the implant “slightly deforms” the substrate crystal lattice, though the substrate remains a single crystal structure (e.g., See Page 3, lines 24-27). In the present invention, this substrate structure coupled with the silicon layer deposition conditions enables deposition of the silicon layer having a different crystalline orientation than the substrate. Because Takizawa's implant conditions are much different than those described in the present application, it would be expected that the resulting effect on the substrate would be significantly different than that in present application. These different effects would, in all likelihood, result in the epitaxial layer grown on the Takizawa substrate failing to meet the claimed limitation that the silicon layer has a different crystalline orientation than the substrate. This falls far short of the burden required to support an inherency rejection that the combination would **necessarily** have led to the claimed limitation. (Emphasis added).

Furthermore, the Meyerson layer deposition process is very different than the process described in the present application. Meyerson utilizes extremely low pressures, in part, so that non-equilibrium processes dominate the growth of the deposited layer. (e.g., See Column 4, lines 29-34). Under such growth conditions and non-equilibrium processes, there is no reason to believe that the deposited layer would have a different orientation than the substrate as claimed. In fact, Meyerson emphasizes how the growth process described therein enhances epitaxial deposition. As known to those skilled in the art, epitaxial silicon layers exhibit the same crystalline orientation as the substrate on which it is formed, in contrast to the limitation in claim 32.

Finally, the conditions in the Kagata deposition step are also different than those described in the present application. As noted above, Kagata describes a pre-treatment step in which the substrate is heated preferably to a temperature of about 1,000 °C or higher, for a

period of 30 minutes or longer (e.g., See Column 2, lines 48-52). This pre-treatment step makes possible the lower deposition temperatures that are claimed (e.g., See Column 3, lines 42-56). One would expect that this pre-treatment heating step would anneal the substrate which would, in all likelihood, heal the local deformation caused by the subsequent implant step. Thus, it would be expected that the substrate in the Kagata epitaxial process would have a different structure than that described in the present invention (i.e., slightly deformed). These differences would, in all likelihood, result in the epitaxial layer in Kagata failing to meet the claimed limitation that the silicon layer has a different crystalline orientation than the substrate. This falls far short of the burden required to support an inherency rejection that the combination would **necessarily** have led to the claimed limitation. (Emphasis added).

The Office Action has not established the necessary burden required to support the inherency rejection because of the differences in the process conditions in the present application (which led to the formation of a silicon layer having a different crystalline orientation than the substrate) and the process conditions in each of Takizawa, Meyerson and Kagata. Therefore, independent claim 32 and its dependent claims, as well as dependent claim 27 are patentable over the combinations, since the combinations fail to teach or suggest each limitation of these claims.

For the above reasons, Applicant respectfully requests withdrawal of the claims rejections on this ground.

Rejection of Claim 20

Claim 20 was rejected under 35 U.S.C. Section 103(a) as being unpatentable over Takizawa in view of Meyerson or Kagata and further in view of Tihanyi or Takiyama and further in view of U.S. Patent No. 4,584,026 (Wu). Applicant respectfully traverses this rejection.

Claim 20 depends from independent claim 1 which is patentable over the combinations of Takizawa in view of Meyerson or Kagata and further in view of Tihanyi or Takiyama for reasons noted above. Because Wu fails to cure the deficiencies of these combinations noted above, independent claim 1 and dependent claim 20 are also patentable over this combination for at least this reason.

Accordingly, Applicant respectfully requests withdrawal of the claim rejection on this ground.

Rejection of Claim 31

Claim 31 was rejected under 35 U.S.C. Section 103(a) as being unpatentable over Takizawa in view of Meyerson and Kagata and further in view of Tihanyi or Takiyama and further in view of U.S. Patent No. 5,441,901 (Candelaria). Applicant respectfully traverses this rejection.

Claim 31 depends from independent claim 1 which is patentable over the combinations of Takizawa in view of Meyerson or Kagata and further in view of Tihanyi or Takiyama for reasons noted above. Because Candelaria fails to cure the deficiencies of these combinations noted above, independent claim 1 and dependent claim 31 are also patentable over these combinations for at least this reason.

Accordingly, Applicant respectfully requests withdrawal of the claim rejection on this ground.

CONCLUSION

A Notice of Allowance is respectfully requested. The Examiner is requested to call the undersigned at the telephone number listed below if this communication does not place the case in condition for allowance.

If this response is not considered timely filed and if a request for an extension of time is otherwise absent, Applicant hereby requests any necessary extension of time. If there is a fee occasioned by this response, including an extension fee, that is not covered by an enclosed check, please charge any deficiency to Deposit Account No. 23/2825.

Respectfully submitted,

By: 

James H. Morris, Reg. No. 34,681
Robert H. Walat, Reg. No. 46,324
Wolf, Greenfield & Sacks, P.C.
600 Atlantic Avenue
Boston, Massachusetts 02210-2206
Telephone: (617) 646-8000

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